STUDIES ON ANTIMICROBIAL PROPERTIES OF APOCYNACEAE MEMBERS FROM MARATHWADA REGION.

Synopsis submitted to
SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

For the degree of
DOCTOR OF PHILOSOPHY (Ph. D.)
Under the Faculty of Science & Technology

In the Subject of
BOTANY

Submitted by
PAWADE VITTHAL ANANDRAO

Under the guidance of
Dr. SURESH.M.TELANG
Assistant Professor,
Department of Botany and Horticulture,
Yeshwant Mahavidyalaya, Nanded (M.S.) INDIA

MAY, 2023

Name of Research Scholar:	Pawade Vitthal Anandrao
Name of Research Guide:	Dr. Suresh.M. Telang, Assistant Professor, Department of Botany and Horticulture, Yeshwant Mahavidyalaya, Nanded
Proposed Research Topic:	Studies on Antimicrobial properties of Apocynaceae member from Marathwada Region

SHORT RESUME

Introduction:

India is proud to be rich in biological plant and one of the mega diversity centers of the world (Chakraborty, S. 2004). Herbal medicines are in great demand in both developed and developing countries as a source of primary health care owing to their attributes having wide biological and medicinal activities, high safety margins and lesser costs. Herbal molecules are safe and would overcome the resistance produced by the pathogens as they exist in a combined form or in a pooled form of more than one molecule in the protoplasm of the plant cell (Lai and Roy, 2004; Tapsell *et al.,* 2006). Many important modern drugs have been derived from plants used by indigenous people (Balick,Cox,1996).

Traditional use of medicine is recognized as a way to learn about potential future medicines. Researchers have identified number of compounds used in mainstream medicine which were derived from ethno medical plant sources (Fabricant and Farnsworth, 2001). Plants are used medicinally in different countries and are a source of many potent and powerful drugs (Srivastava, *et al.*, 1996).

In the US, almost 1800 medicinal plant species are commercially available. It has been estimated that about 13, 000 species of plants have been employed for at least a century as traditional medicines by various cultures around the world (Tyler 1993). A list of over 20,000 medicinal plants has been described by Deans and Svoboda 1990 and very likely a much larger number of the world's flowering plant species have been used medicinally. Sometimes the figure of 70,000 medicinal plant species is cited, but this includes many algae, fungi, and micro-organisms. In any event, there is no other category of plants useful to man that includes so many species and the question naturally arises why such a staggering number of plants have useful medicinal properties. Medicinal plants and their therapeutic potential have always drawn curiosity and attention to search their antimicrobial activities.

It is evident from the literature that theMedicinal plants represent a rich source of antimicrobial agents. Millions of rural household use medicinal plants in a self-help mode. Over the Indian system of medicine, the medicinal plants in preventive and curative application and for treating various diseases in different system are used. As per the world health organization WHO report, 80 % of world population presently use herbal medicine for some aspect of

primary health care. Since the decade the rise in the failure of chemotherapeutic and antibiotic resistance exhibited by pathogenic microbial infectious agents leads to the screening of several medicinal plants for their potent antimicrobial activity.

The antimicrobial properties present in the medicinal plants may be the great reservoirs of new potential drugs. It may prove huge resource for the coming new biotechnologies. They may prove key resources for new genes and biotechnologically valuable compounds. Phytochemicals are now seen as the first step towards the discovery of useful drugs. The studies on antimicrobial activities of medicinal plants needs to be studies the region. Considering these facts the topic **Studies on antimicrobial properties of Apocynaceae member from Marathwada Region** is selected for the proposed research work.

Geographically,Marathwada region of Maharashtra state is poised for dry and hot climate for most part of the year with a brief spell of monsoon and a relatively mild winter. Present endeavor aims at better utilization of available information about the plants of Apocynaceae. Apocynaceae is a family of flowering plants that includes trees, shrubs, herbs, stem succulents, and vines, commonly known as the dogbane familybecause some of the plants of this family are used as dog poison(Endress and Bruyns, 2000). The family Apocynaceae contains 348 genera Nazia Nazar et al, 2012). Some of the plants of Apocynaceae are such as

1. ***Alyxia oliviformis*(maile):** The bark and leaves of this native Hawaiian vine are used to make fragrant lei.
2. ***Allamanda cathartica* (allamanda):**Climbing ornamental shrub with large yellow tubular flowers to about 3 inches in diameter. The leaves contain a cathartic.
3. ***Allamanda schottii* (allamanda):** Small shrub with yellow tubular flowers smaller than preceding species. Fruits globose, prickly, burlike.
4. ***Alstonia scholaris* (devil tree):** Small tree along road sides.
5. ***Beaumontia jerdoniana* :**This species has a very broad corolla tube which makes it possible to easily see the anthers adhering to the stigma.
6. ***Carissa macrocarpa* (Natal plum):** In this species the tube of the 5-lobed corolla is very narrow. The paired red fruits are developed from the separate ovaries of the single pistil. They diverged during the maturation period following abscission of the unifying style (one ovary often aborts).
7. ***Cascabe latheveti*, (be-still tree):** This is another example of a poisonous member of the family. Note the small droplets of white sap seeping out of the lower half of the fruit.
8. ***Catharanthus roseus*, Madagascar periwinkle.** Perennial herb or low shrub from W. Indies, with white or pink, slenderly tubular flowers; often used as a ground cover.
9. ***Nerium oleander*, oleander.** This is a highly poisonous member of the family. The flowers have a fringe of extra appendages in the throat of the corolla.

10. ***Plumeria obtusa*, Singapore plumeria.** This is one of the very common lei flowers ***Tabernaemontana divaricata*, paper gardenia, crape jasmine.** Shrub with white, often "doubled" flowers. Wood used for perfume and incense; plant has medicinal value but roots said to be poisonous.
11. ***Vinca major*, periwinkle.** A common ornamental plant
12. ***Cascabela thevetia*, be-still tree.** This is another example of a poisonous member of the family. Note the small droplets of white sap seeping out of the lower half of the fruit.

Several members of the family Apocynaceae have had economic uses in the past. Several are sources of important natural products. Many of the genera of this family are known to contain glycosides such as *Acokanthera*, *Apocynum*, *Cerbera*, *Nerium*, *Thevetia* and *Strophanthus. Rauwolfi a serpentina* (Indian snakeroot) contains the alkaloid reserpine, which has been used as an antihypertensive and an antipsychotic drug but its adverse effects limit its clinical use. *Catharanthus roseus* yields alkaloids used in the treatment of cancer (Arora et al, 2010).

Review of Literature:

Doughari.et al. (2008) studied antibacterial activity of leaf extracts of *Sennasiamae*. They tested aqueous and organic leaf extracts of the plant *Sennasiamae*, traditionally used for the treatment of infectious disease, their activity against clinical isolates of *Salmonella typhi* using the disc diffusion method. Shah and Chakraborty et al. (2010) studied pharmacognostic properties of plants. They found that the *Nerium* leaves showed the presence of alkaloids,tannins and proteins were found to be present in aqueous extract whereas Steroids and saponins were also found in Alcoholic extract.

Ravirala Venkateshwarlu et al. (2011) studied medicinal applications and biological activities of medicinal plants. According to them, the global scenario is supporting the development of modern drugs from less toxic plant products with proven medicinal properties. In India, medicinal plants are widely used by people as folk remedies or in different indigenous systems of medicine like Siddha, Unani and Ayurveda. Manimegalai and Rakkimuthu(2012) carried out phytochemical screening of stem of *Couroupita guianensis* (Lecythidaceae) , which is a medicinal plant which is endowed with curative properties including antifungal, antibiotic, antiseptic, analgesic, antimalaria, stomach ache, tooth ache, scabies, gastritis, bleeding piles, dysentery and scorpion poison. Their study deals with the preliminary phytochemical screening of the stem of *Couroupita guianensis* with various extracts such as petroleum ether, benzene, ethanol and water. This includes the powder characteristics studies, fluorescence studies and thin layer chromatographic studies of the stem powder. The qualitative analysis of some secondary metabolites, to ascertain medicinal claims of this widely used medicinal plant. The results showed that the moderate presence of alkaloids, flavonoids, steroids, amino acids, phenols and triterpenoids.

Priya et al. (2012) studied antifertility activity of medicinal plants. According to them the use of plants as abortifacient and as contraceptive was well known to the ancient physicians of India. The profiles presented by them include information about the scientific name, family, the degree of antifertility activity and the active agents. Totally 50 species are listed in the present review.

Udaya Prakash et al. (2013) studied antimicrobial, antioxidant and pesticidal activity of leaves of medicinal plants.They evaluated Aqueous, Chloroform, Methanol and Hexane extract of the leaves of the *Alangiumsalvifolium* for antibacterial, antioxidant, larvicidal and pesticidal potency.

Objectives of Research:

1.Reference work.
2.To screen and identify various plants of apocyanceae family with potential antimicrobial properties.
3.To extract and isolate Bioactive compounds from selected apocyanceae plants for further analysis.
4.To determine the antimicrobial efficacy of the extracted compounds against a range of both gram-positive and gram-negative bacteria and fungi.
5.To evaluate the minimum inhibitory concentration(MIC) of the bioactive compounds against the target microorganisms or pathogens.
6.To investigate the mechanisms of action of the identified bioactive compounds against the tested microorganisms.
7.To identify any synergistic effects between the bioactive compounds with the plant for their antimicrobial properties.
8.To correlate the antimicrobial activity of the identified bioactive compounds with their chemical composition and structural properties.
9.To contribute to the development of novel and effective natural antimicrobial agents using Apocyanaceae plants for various application,including pharmaceutical,agricultural,and cosmetic industries.

Methodology to be adopted:

The screening of antimicrobial activity of plants of Apocynaceae would be carried out by different methods as described by , Mahadevan and Sridhar (1996), Wallis(1985), Narayan et al (2003), Ravirala Venkateshwarlu et al (2011), Manimegalai and Rakkimuthu(2012) and Udaya Prakash et al (2013).

Importance of study:

Apocynaceae is a family of flowering plants that includes trees, shrubs, herbs, stem succulents, and vines, commonly known as the dogbane family because some of the plants of this family are used as dog poison (Endress and Bruyns, 2000). The family Apocynaceae contains 348 genera Nazia Nazar et al, 2012). Several members of the family Apocynaceae have had economic uses in the past. Several are sources of important natural products. Many of the genera of this family are known to contain glycosides such as

Acokanthera, *Apocynum*, *Cerbera*, *Nerium*, *Thevetia* and *Strophanthus. Rauvolfi a serpentina* (Indian snakeroot) contains the alkaloid reserpine, which has been used as an antihypertensive and an antipsychotic drug but its adverse effects limit its clinical use. *Catharanthus roseus* yields alkaloids used in the treatment of cancer (Arora et al, 2010).

Proposed Work Plan /Formulation and Structure of study:

First Year:

(a) Reference work

(b) Survey and Collection and Identification of plants of Apocynaceae

(c) Screening of Antimicrobial activity of plants Apocynaceae.

Second Year:

(a) purification of biologically active compounds from various plant parts.

(b) Assesment of antimicrobial properties antibacterial and antifungal of the purified compounds.

Third Year:

(a) Characterization and purification of the compound.

(b) Assesment and application of the purified extract components for its activity.

References:

- Tapsell,L.C.Hemphill,I and cobiac,L.,(2006)Health benefits of herbs and spices:Thepast,the present,future.Med.J.Aust.185(4):4-24
- Tyler V.E.,(1993)The Honest Herbal .A Sensible Guide to the Use of Herbs and Related Remedies,3rded.Pharmaceutical products Press,Binghamton,NY
- Doughari J.H. et al. (2008) studied antibacterial activity of leaf extracts of *Sennasiamae*
- Shah and Chakraborthy et al. (2010) studied pharmacognostic properties of plants
- Ravirala Venkateshwarlu et al. (2011) studied medicinal applications and biological activities of medicinal plants
- Manimegalai and Rakkimuthu(2012) carried out phytochemical screening of stem of Couroupita guianensis (Lecythidaceae)
- Priya et al. (2012) studied antifertility activity of medicinal plants
- Udaya Prakash et al. (2013) studied antimicrobial, antioxidant and pesticidal activity of leaves of medicinal plants.
- Srivastava, J., Lambert, J., and Vietmeyer, N. (1996) "Medicinal Plants: An Expanding Role in Development". *World Bank Technical Paper.* 320.
- Endress ME, Bruyns PV (2000): *A revised classification of the Apocynaceae s.l. (PDF)*. The Botanical Review. 66 (1): 1–56.
- Nazia Nazar, David J. Goyder, James J. Clarkson, Tariq Mahmood and Mark W. Chase(2013): The taxonomy and systematics of *Apocynaceae*: Where we

stand in 2012," *Bot. J. Linn. Soc.*, 171(3, March), pp. 482–490, see [1], accessed 22 June 2015.

- *Arora, R., Malhotra*, P., Mathur, A.K., Mathur, A., Govil, C.M., Ahuja, P.S. (2010): Chapter 21 Anticancer Alkaloids of Catharanthus roseus: Transition from Traditional to Modern Medicine. *Herbal Medicine: A Cancer Chemopreventive and Therapeutic Perspective (1 ed.). pp. 292–310. ISBN 9788184488418.*

Signature

Research Scholar

Signature

Pawade Vitthal Anandrao

Research Guide
Dr.Suresh M.Telang